nuance



NORTHROP UNIVERSITY Spring 81

ROOTS OF EXPLORATION

Explore: the roots from Old French mean the outcry of hunters when sighting game.

Webster's New International Dictionary

The roots of the word "explore" show a primal interdependence of the human abilities to hunt and to speak. The mind, like a hunter, has survived by constantly honing new tools to explore and communicate in new environments.

25,000 years ago, the migrant hunter ventured from cave to cave exploring the boundaries of new territory. Today, as man enters an area dominated by "the cold soak of space," small isolated stations are again about to become outposts of exploration. The migrant hunter is about to take another evolutionary step as he enters the Ice Age of space.

More than ever before, the force of discovery depends on the ability to communicate it. Isolated discoveries have no way of survival. This issue of Nuance is an exploration. It is a means of making discovery known as several generations of explorers speak out about their experiments and ideas.

Nuance hopes to encourage exploration, in both the scientific and cultural meanings of the word, by providing the communication channels necessary to keep it alive.

The Editor,
Michelle O' Daniel

nuance

Volume Two Number Two

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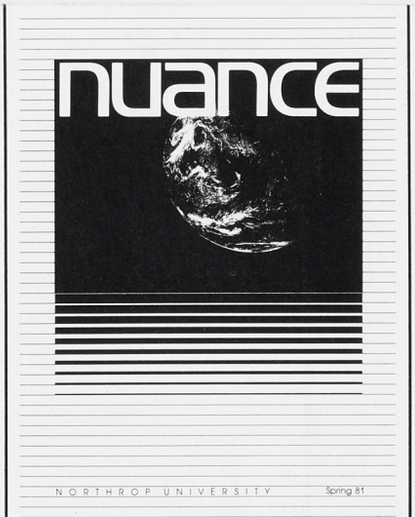
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on the cover:
Design by Alan Abelhouzen
Photo courtesy NASA

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Photo courtesy NASA

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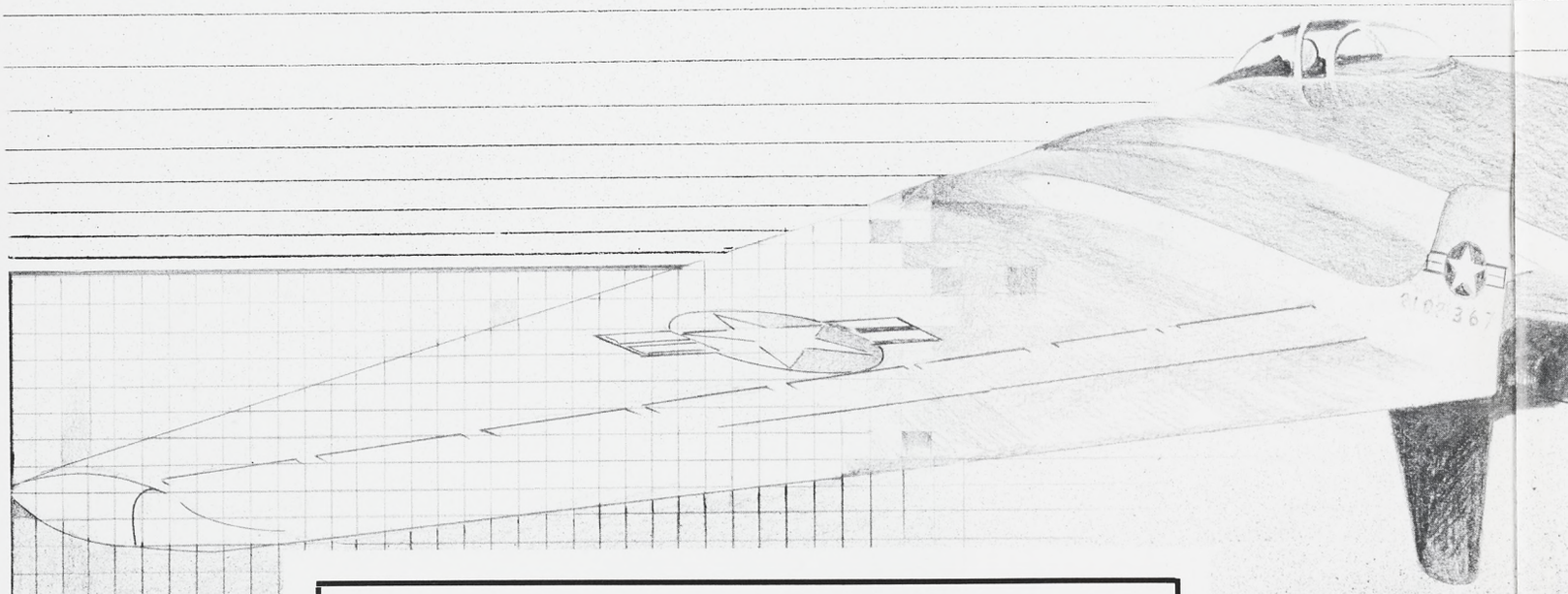
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Passing On the Dream



An Alumnus Meets John K. Northrop

The first flight of the Flying Wing Bomber inspired more than a few careers in aviation. Ron Beecher's was among them. He remembers peering over the fence at Hawthorne Airport, California, when he was just fourteen years old and watching pilot Max Stanley lift the historic and controversial Flying Wing into the air for the first time. It was one hundred tons flying.

In 1953, all the Wing Bombers were ordered destroyed for undisclosed reasons by the Secretary of Defense, Stuart Symington. The only man who knew the reason was John K. Northrop, designer of the Flying Wing. Ron Beecher was determined to meet him.

"All my life, I wanted to pilot the Flying Wing,"Ron smiled. That thought motivated him through aeronautical engineering at Northrop Institute of Technology and throughout his eleven years as a Navy pilot. Today, in his determination to build a home-built and scaled-down model of the Flying Wing, Ron Beecher finally met with both the designer, John Northrop, and the test pilot, Max Stanley. (continued)

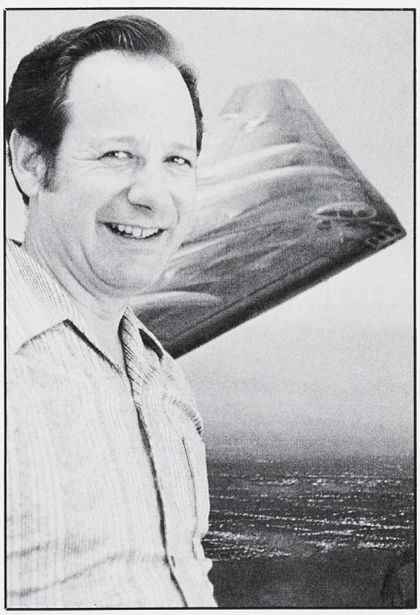
ALAN J ABRAHAMSON
'81

"I figured if the United States government invested millions to build over a dozen Wing Bombers, it was because the design worked, and it worked well," Ron explained. "The Flying Wing outflew every conventional design plane of its time." However, since all the mathematical models for the all-wing aircraft were destroyed with the bombers, the mystery plane would have to be re-created from drawings and personal recollections.

It was early in 1979, when Jack Northrop was nearly eighty years old, that Ron Beecher and members of the Experimental Aircraft Association received an invitation to his home in La Canada, California. It was an afternoon Ron Beecher had been waiting for all his life. "I never thought such an important man would be so accessible," Ron smiled. "We knew he was not well, so we went with the intention of staying only forty-five minutes. Mr. Northrop wouldn't let us leave for two hours and forty-five minutes."

Ron took the first opportunity as he walked in the door to thank the man who gave his name to the Aeronautical Institute. "I kept calling him 'Mr. Northrop,' and he kept saying, 'Just call me Jack. My name is Jack.'"

His mind was clear, his voice steady. Only his body was shaken by the advancing Parkinson's Disease. It was obvious Northrop wanted to talk to this group of Flying Wing enthusiasts who came to him for advice about building a man-carrying model. "Don't use the N1M as your prototype," he advised. "That was an experimental model to determine the wingtip droop and sweep of the wings. The N9M's were the result of the best configuration that the N1M's flew."



Ron Beecher, American Airline pilot and Aeronautical Engineering graduate in 1955, asked Jack Northrop about design problems of a home-built, man-carrying Flying Wing.

Ron Beecher was satisfied. He heard what he had come to hear. From then on, his mathematical plans would be based on a scaled-down version of the 60 foot N9M. With those few words of advice, Northrop had saved Ron months of experimental work.

Now that the prototype had been determined, Ron could go on to some of the questions he knew only Northrop could clarify. Ron wanted to know first hand what startea Northrop thinking about the design of an all-wing aircraft. The aviation pioneer was amused at the question. Northrop considered each of his innovative aircraft designs from the Lockheed Vega to the Grumman and Alpha and Gamma series to be a gradual development into the cleanest and most efficient aircraft possible to their technology.

"The Flying Wing was the logical end product," Northrop said. "It was the ultimate that I could imagine at that time to reduce redundant structure and extra weight. The wings for their time were tremendously efficient structurally. The B-49's carried one and one-half times their own weight in useful payload, cargo and fuel. It can be extrapolated now," he continued, "with modern knowledge as to structure and materials and powerplants, that a cargo plane of this type could carry twice its own weight, which is 60% more than Boeing does with the 747 Jumbo Jet."

It was plain to see. Northrop never retired his imagination. "All I want now," Northrop said steadily, "is for NASA to include an all-wing aircraft in their competition to find the most efficient cargo plane possible. They have 600 million dollars to do this and I want to see how the wing would place in a competition of various types of aircraft."

Northrop never stopped searching for official vindication of his cancelled aircraft, the Flying Wing. "I want to see some sort of statement that NASA has investigated the wing," he said, "and that it has a practical and useful design. There should be some statement that it was cancelled for reasons that had nothing to do with the technical characteristics. If that's done," Northrop smiled, "and nobody wants to pick it up, O.K. The facts will stand."

During that afternoon with John Northrop, Ron learned the deep personal loss and anger Northrop suffered over having to supervise the destruction of his own aircraft for what he knew to be unjust reasons.

"When he would speak about the Secretary of Defense, Stuart Symington, he just shook with anger," Ron noticed. "It was a quiet anger, but you could see that after thirty years, he was still boiling inside."

John Northrop effectively resigned from Northrop Aircraft Corporation after the cancellation of the Flying Wing Bomber contract by the Secretary of Defense. For years, he lived with the knowledge that he had been forced to kill his aircraft by a man who had a personal interest in the merger of Northrop Corporation and Consolidated Vultee, a powerful competitor. Northrop refused the merger; his company survived as an independent corporation. As a result, the Flying Wing was ordered cancelled. Just a few months prior to his death, John Northrop agreed to release the political facts behind the destruction of the Flying Wing. Until then, he had feared reprisals might be levied against Northrop Corporation.

Popular speculation held for thirty years that the Flying Wing was ordered destroyed for reasons of

instability and poor control at high speeds. The cause of the fatal test-flight crash at Muroc Lake in 1948, where Captain Glen Edwards and crew were killed, became a life-time preoccupation and sadness for John Northrop. During the course of the afternoon interview he was asked about the accident.

"Jack," Ron asked, "We've heard that the YB-49 had the flying characteristics that if you started in any degree down, it picked up speed so rapidly you had to be careful not to exceed red line. Am I right?"

Northrop was obviously pained by the question. "That is considered to be the cause of Captain Edward's crash. Actually, he was flying at somewhere around eight or nine thousand feet over 2500 foot terrain. He was doing stall tests and he didn't have room. Only a couple of people saw the crash from a great distance, so there is really no one reliable to talk about it," Northrop said.

As the conversation progressed, Northrop did emphasize that a group of flight test engineers in Lancaster, California, unanimously agreed that the crash was due to pilot error. Unfortunately, nothing could be proved conclusively and nothing could out-weigh the years of propaganda against the stability of the flying Wing. Typical of the campaign against the aircraft was a printed statement attributed to Major Cardenas, another Air Force flight test pilot.

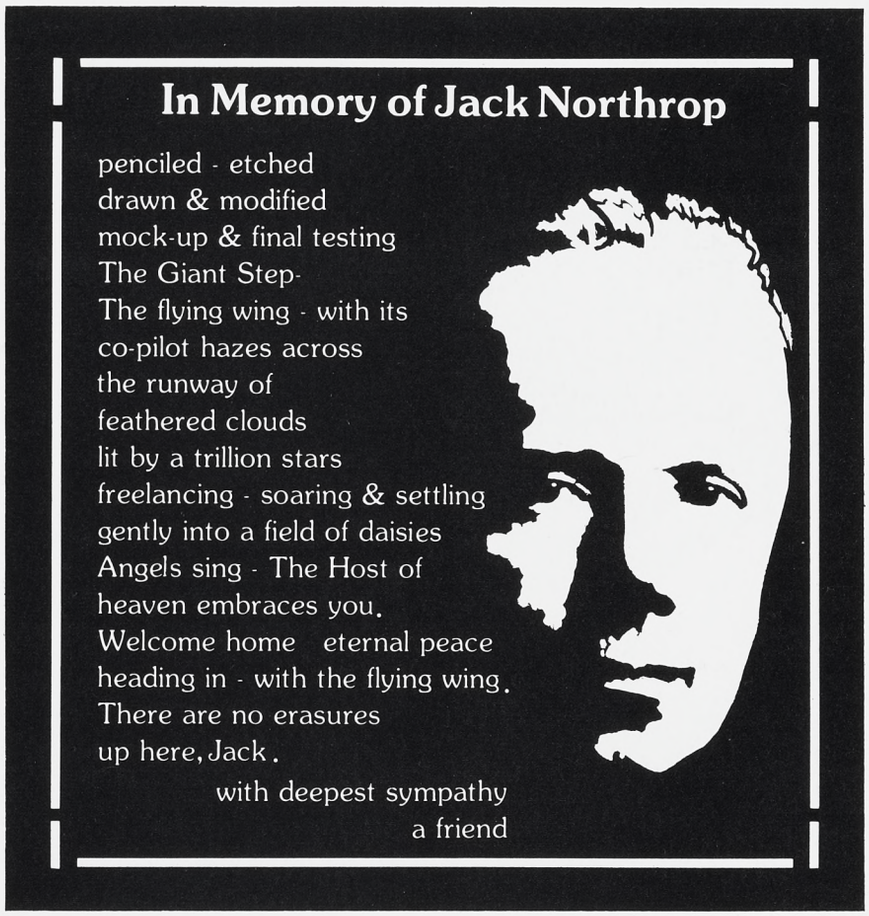
Northrop quoted the words as though they had been permanently printed in his memory: "Major Cardenas said the YB-49 'was extremely unstable and very difficult to fly on a bombing mission because of continual yawing and pitching caused by the control arrangement.'" Northrop then explained how Max Stanley, the original test pilot of the Flying Wing, had written Major Cardenas asking if he had indeed made the statement. Major Cardenas answered saying he never had. "But this was typical of the sort of propaganda encouraged by the Defense Secretary, Stuart Symington," Northrop added.

At this point, Ron Beecher, a DC-10 co-pilot and 707 pilot, made a necessary point. "There two auto-pilots working all the time in a DC-10. There are four yaw-dampers at work to keep it stable and running. It flies magnificently with all these artificial means of stabilization. All the modern technology we have today would have made that Flying Wing just dead stable."

From an engineer's standpoint, Ron could not understand the total destruction of all plans and mathematical models of the Wing aircraft. "If one, just one had remained in existence, just imagine the technology we could have moved into," he reflected. "I am convinced that Stuart Symington as Secretary of Defense had no idea of the value of the Flying Wing. He had his reasons for not supporting Northrop Corporation's government contract to build the heavy bombers and some of those reasons were personal."

Northrop never made these facts public until months before his death, when he gave permission to Clete Roberts to release a taped interview on the reasons behind the destruction of the Flying Wing. It was a victory of sorts for John Northrop to know the story had been told. Stuart Symington refused to comment and since many of the key individuals of the Flying Wing era had since died, the entire story is still clouded.

One thing remained clear to Ron Beecher. He had met a giant in aerospace engineering. "A man," as Ron explained "almost too humble for his accomplishments." Northrop was more concerned with the product than the praise. He told the Experimental Aircraft group as they left his home, "No need to mention my name when you get your Flying Wing airborne," he said. "The glory is all yours. It will be your plane, you built it." But Ron Beecher is not one to be easily dissuaded. "We're going to thank everyone from Leonardo da Vinci onward, including you Mr. Northrop," he said, "I mean Jack." nu



Presented anonymously to Northrop University with a donation to the John K. Northrop Memorial Fund.



Test Pilot of the Flying Wing

On the morning of June 26, 1946, Max Stanley taxied the Flying Wing Bomber into position at the west end of the Hawthorne runway and spoke to the tower:

"This is it. Here we go!"

After using only half the runway, Stanley pulled up the giant Wing and climbed quickly to 10,000 feet where he leveled and headed for Muroc Lake. It was the first flight of the XB-35, propeller version and it was an amazing no-fault manuever.

During the first crucial years of Wing development, Max Stanley was one of the pilots to test the flight characteristics of the prototype N9M, the propeller bomber XB-35, and the jet conversion YB-49. Stanley made the first flights of both the propeller and jet bombers in a day when the only way to test an airplane was just to get in and fly it. There were no flight simulators. The only jet training he had was a quick circle around the Northrop field in a P-80, with Chuck Yeager in the jump seat behind him. As Max told it, "Chuck Yager got out after one circle and said, 'O.K. Max, now you're a jet pilot.'" And Max took off fully qualified.



Even the quiet-mannered John Northrop was visibly impressed with the pilot. In an interview about the Flying Wing, Northrop burst out, "Max! He's the man you should talk to. He's the one who took it up and flew an unknown aircraft. He had to have guts." When Max Stanley heard the story years later, he laughed, "More guts than brains."

More of a cautious enthusiast than a white-scarfed daredevil, Max

Max Stanley visited Northrop University in June, 1981.


Roy Stanley

"Max! He's the man you should talk to. He's the one who took it up and flew an unknown aircraft. He had to have guts."

John K. Northrop

Stanley made one condition when Northrop hired him. "I told him," Max recalled, "that I would never fly a Flying Wing!" It didn't take the former airline pilot long to get to the point where he could hardly wait to get in one.

From then on, John Northrop and Max Stanley worked together to develop what was to become a flying legend. With no fuselage, the all-wing aircraft was a unique combination of lift, maneuverability, and speed. The silver V-shaped Wing sliced through the sky at speeds up to 500 m.p.h. Designed to carry a gross weight of 209,000 pounds over a 4,000 mile range, the Wing was considered the most advanced aircraft of its time.

"As a bomber, or a cargo-carrying airplane," Max explained in an interview at Northrop University this year," the Wing is THE airplane. And it still is."

"Any one who ever saw the Wing fly, never forgot it," Max reminisced with a mixed feeling of pride and disappointment. "It's absolutely inconceivable," he said, "that someone would order them destroyed."

With the total destruction of both the planes and their engineering specifications, the Flying Wing became one of the mysteries of aviation history. That part of history is in the memory of those who were there. "The YB-49 was a beautiful machine, a gentle giant," Max continued as he looked down at his hands. "I think the man who ordered them destroyed was a traitor to his country."

In 1953, the Secretary of Defense, Stuart Symington cancelled the military contract for the YB-49's and ordered all remaining planes to be cut up with acetylene torches and sold as scrap. For thirty years, there was no clear explanation given for the multi-million dollar waste. Even Max Stanley was never told the real story. Like everyone else at Northrop Aircraft, he was shocked at the sudden decision. "It was all speculation," he said, "There was never any official announcement as to why the program was cancelled."

"The story told at the time of the destruction was that the Flying Wing with a 4,000 mile range could not fly to a target in Russia and return to the United States. It would have to stop and refuel in Africa or Turkey," Max explained. "They said that with the new scenario after World War II, there would not be a friendly base within the range of this airplane after dropping the bomb. The B-36 had a range of 10,000 miles, so theoretically they went with that."

The first Max Stanley heard about the political reasons for the cancellation was during the television broadcast of an interview in 1980 when Northrop made it clear to Clete Roberts that Defense Secretary Symington had tried to pressure him into merging Northrop Aircraft with Consolidated Vultee. When Northrop refused, Symington took the punitive action of cancelling Northrop's military contract for the Flying Wing Bomber.

According to Max Stanley, the Wing did have its problems. The XB-35 propellers would feather without warning and sometimes the props would not unfeather. At one point, Max had to land a YB-49 with four of its eight engines out. When the XB-35 was modified to the jet engined YB-49, it was wind tunnel tested and found to have lethal stall characteristics with an aft center of gravity. Stanley watched from an observer P-61 as another test pilot took the YB-49 into a stall with its CG at the rearmost position. "The manuevers that thing went through with an aft CG are absolutely incredible," Max said. "I don't know what the maneuvers were, and I don't think the pilot knew what it did. It was totally out of control. I think it even got upside down. It lost a lot of altitude before it finally did become controllable."

That was the last time the Wing was stalled with an aft CG. "One stall like that was enough," Max smiled. In his usual mixture of caution and courage, he added, "but I never felt that this was really detrimental to the airplane because the only way you could get an aft CG was by gross mismanagement of the fuel system. If you used the outboard tanks first, then the CG moved forward. But if the flight engineer got confused and used the forward tanks first, then the CG would shift and you could get into real trouble."

After 27 years as a test pilot, Max Stanley concluded "I don't believe there is a way to design a fool-proof aircraft." Many people believe that the fatal Glen Edwards crash in the Flying Wing was due to pilot error, but nothing conclusive was ever proven. "We do know that the wing tips were found at some distance from the wreckage which indicates that the plane was overloaded at a positive acceleration. Why," Max concluded, "nobody knows." An area of speculation is that Captain Edwards did not realize the acceleration rate of the Wing as it desended from 9,000 feet over 2,500 feet terrain.

Much of the jet aircraft's aeroelastic characteristics were learned only through trial and error. "We could get to a speed where you got aileron reversal," said Max smiling. "That was kind of new for us. At high speeds, if you turned the stick one way, it banked another."

Despite the adverse publicity given the Flying Wing after the Edwards crash, Max Stanley believed it was an acceptable bombing platform. "It had the peculiar characteristic of not really caring whether it was flying straight or at a yaw, but after the yaw-damper was put in," he explained, "it met all the performance guarantees and the military determined it to be acceptable; hence, the contract

"More guts than brains."

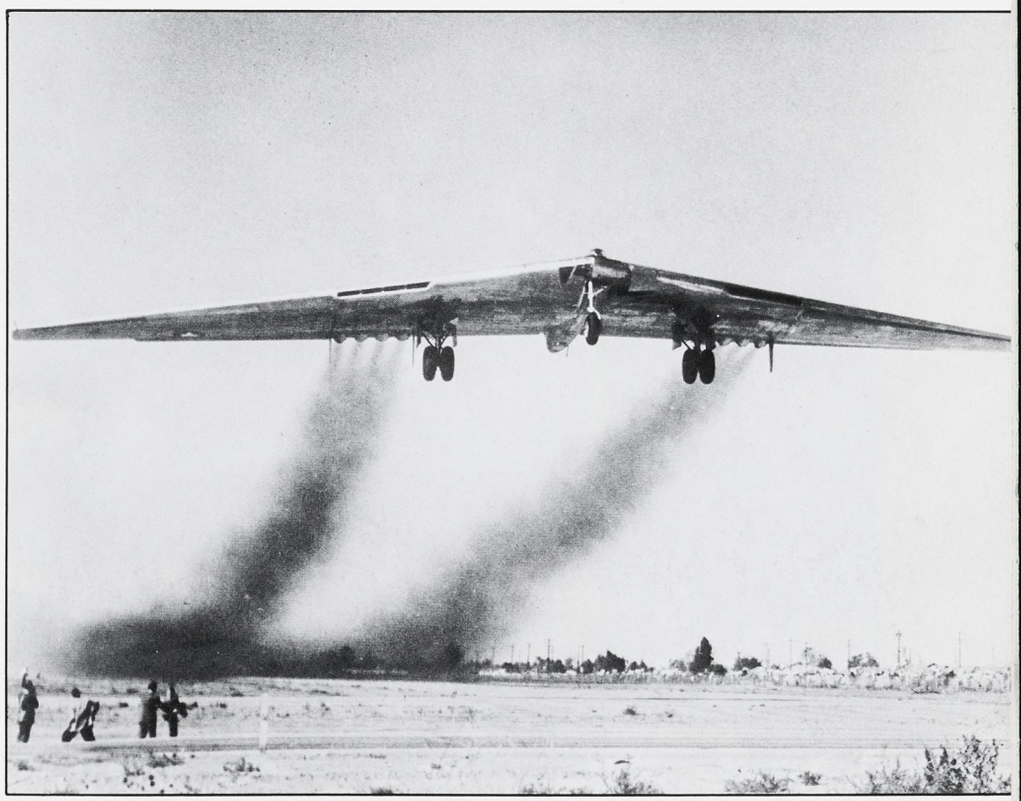
Max Stanley

came to build more of them."

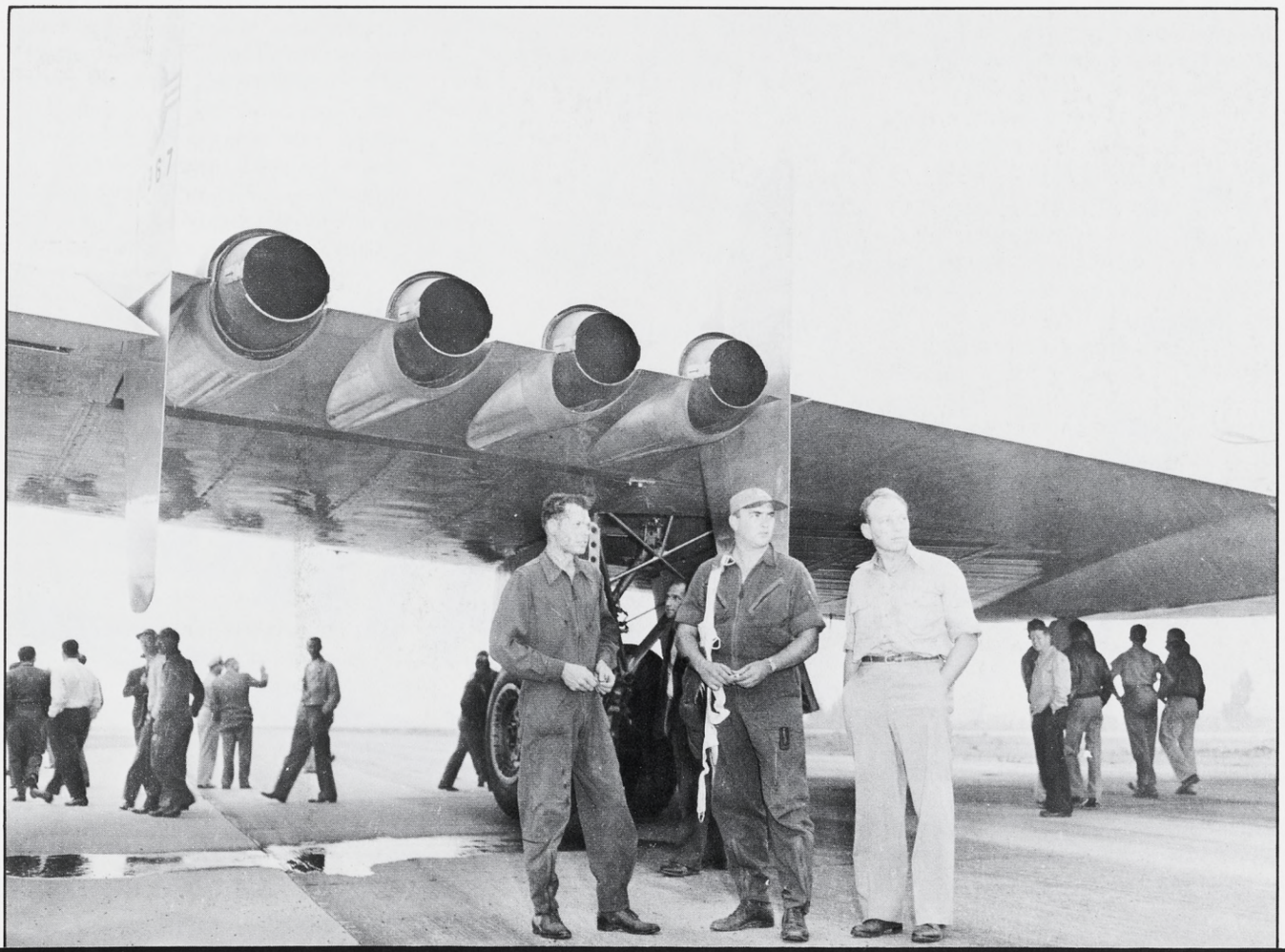
According to Max, NASA has had three studies made about what the next generation cargo airplane is going to look like. "Now, you're talking about airplanes in the gross order of one million and a half pounds," he said. "When you get to that size, they too look like Flying Wings. But they call them span loaders."

During the afternoon interview, Max Stanley stopped and shifted emphasis. "Now, I have a story to tell you," he began, "about Northrop, himself, on that morning in 1946 when the first Flying Wing bomber took off. Apparently Northrop Aircraft had decided it would be hazardous to have too many people on the runway during the take off. So, Personnel sent a memo around to all employees instructing them to remain at their desks for the initial take off. So, at that moment when the first bomber that had taken twenty years of designing finally lifted off, Northrop himself, like all the other employees was at his desk. He never saw the first lift off. He considered himself just another employee."

Northrop, Max Stanley and the Wing were a unique combination of humility, daring, and good form.



(Above) In May, 1948, a YB-49 was flown on an endurance test from Fresno, California to Phoenix, Arizona, covering 3,458 miles in 9½ hours at 40,000 feet altitude. On June 5, 1948 the same YB-49 crashed near Muroc Lake killing the five crew members, including Captain Glen Edwards, the pilot.
(Below) Crew members of another YB-49 from left to right: Orva H. Douglas, Fred C. Bretcher, and Max Stanley, pilot.



IN MEMORIAM







David Daniel Hatfield

1903-1981

COWBOY—RANCHER—PILOT—MECHANIC—ENGINEER—INVENTOR—HISTORIAN EDUCATOR—PHOTOGRAPHER—ARTIST—RESEARCHER—AUTHOR...GOOD FRIEND!

We have had a rare privilege...the privilege of loving, working with, and enjoying a truly remarkable, extraordinary and unique man.

David Hatfield was born in a covered wagon around the turn of the century in the Oklahoma Territory. As for his birthday, July 1 1903 , he picked it. To him, it satisfied anyone's asking and it did not detract from other important events.

David's love for aviation started in the '20's as a barnstorming pilot, mechanic, engineer and businessman. His dream for preserving aviation history started at the same time; his knowledge of photography made it a natural. The American Hall of Aviation History at Northrop University is a testament to David and his dreams becoming a reality. The collection consists of over 300,000 negatives and photos, magazines, books, reference materials and film that no longer exist except in his collection. David is internationally known and respected for his first-hand knowledge, his lifetime research and experiences in the development of aviation.

He was recently appointed chairman of the committee to select the world's major airlines for the Franklin Mint Silver Insignia Collection. He worked continuously with film companies, magazines and authors, providing detailed information on aircraft companies and personalities. He also found time to author a series of books on aviation history which have become collectors' items.

Of his many awards, some of the notable ones are the Robert Wanamaker Award, the Southern California Outstanding Citizen's Award, the OX5 President's Citation, the Air Force Association Appreciation Plaque, and currently, he has been nominated for the Aviation Hall of Fame.

David was active in the Los Angeles Breakfast Club, the OX5 Club, the Quiet Birdman, the American Society of Photogrammetry, the Society of Automotive Engineers (SAE), the Experimental Aircraft Association (EAA), and many others.

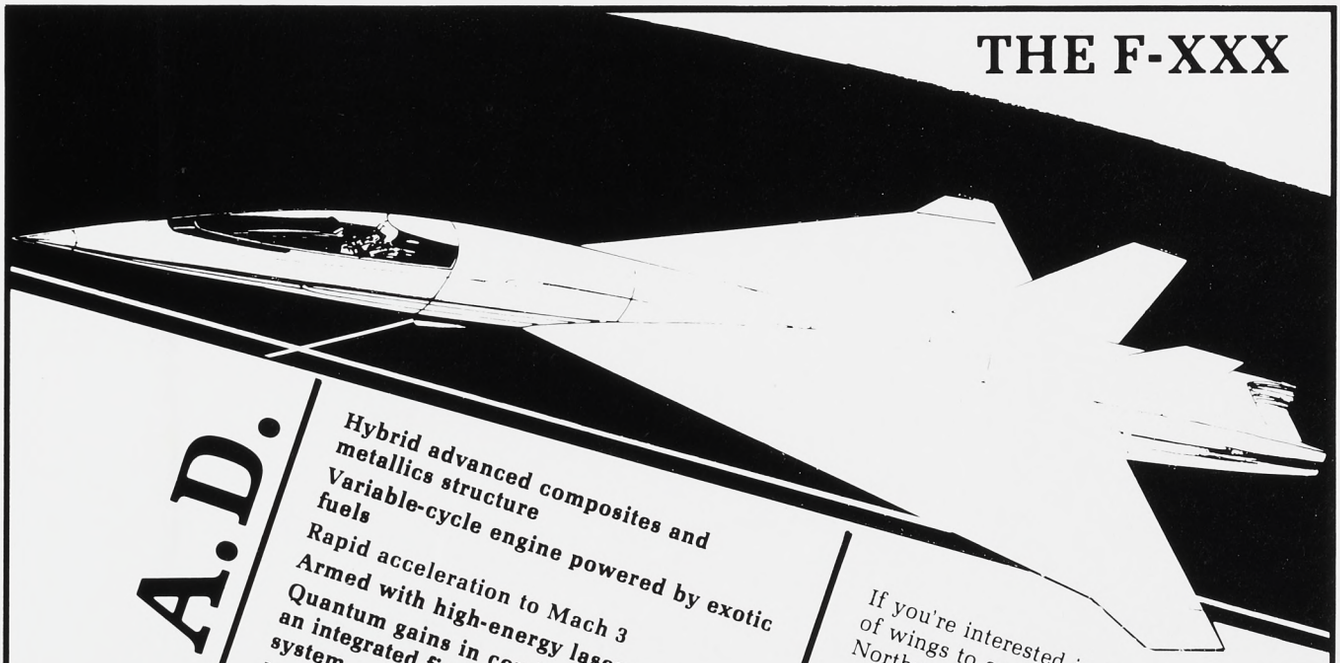
His monumental project to chronicle man's flight was almost complete. He left 2,000 hand-painted photographs of the history of flight from myth to modern day and 160 hours of video cassette film documentary.

David had picked a location to retire. It was a small place on the New Mexico - Arizona border in New Mexico. He had surveyed this area in the '20's. It has an old house which he intended to rebuild with adobe, having learned the art of working with adobe as a teenager. He intended to generate electricity from the wind. He had researched windmills and knew exactly how they would be constructed to achieve maximum effect. He had determined that pure, clean water was available; he intended to have a vegetable garden to supply his needs. He would plant the fields in clover. The clover would have purple blooms; from the air it would look like a blue sea. His friends would come and visit. They would land their airplanes in the clover field.

If you have tears, let them be tears of joy; if you have a heavy heart, let it be uplifted, for I believe David has his dream. I believe David has his landing field of clover; I believe David is with his friends. Can you imagine the reception committee: Roscoe Turner, Jack Northrop, Fish Salmon, Don Douglas, Charles Lindberg, Tiny Broadwick, Amelia Earhart, and Major Bong? And I will lay odds that the clover field is covered in purple blossoms!

Eulogy delivered
June 29, 1981
by Joseph C. Miles
Director, Institute of Technology

THE F-XXX



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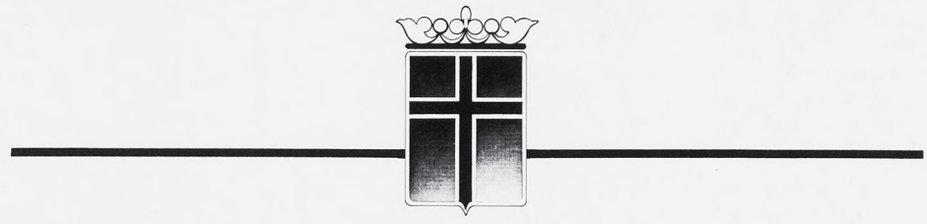
Aircraft Division

NORTHROP

Making advanced technology work.



KNUT HAGRUP



An airline man,
fascinated by the global effects of the aviation industry,
Knut Hagrup has become a one-man index
to the development trends in world aerospace.
This year, he joins Northrop University
as a member of the Board of Trustees
and a Laureate Professor of Law.

Beginning as a pilot in the Royal Norwegian Air Force and retiring as President of Scandinavian Airlines, Knut Hagrup has spent over forty years in the aviation industry. Today, he is probably among the most active group of retired presidents in the world. As both Chairman of the Air Transport Committee of the International Chamber of Commerce, and Chairman of the European-American Saab-Fairchild aviation venture, he provides a life-line of information between Europe and the United States in airline stock market trends, profits and losses, research break throughs, and sales agreements. "Generally," he smiles, "I've got to know who's making the money in aerospace." And he has to figure out why.

Softspoken but intense, Knut Hagrup can extemporize for hours on aerospace development costs, export figures, and sales reports. As a board member of more than a few European companies, he is constantly asked for his forecast of aerospace trends.

Ever since 1946, when he first joined Scandinavian Airlines, Knut Hagrup knew that the future costs of aerospace development would necessitate joint cooperative ventures of various international aircraft manufacturers. Today, his forecast is materializing in the joint aircraft building ventures of Douglas and Fokker, Saab and Fairchild. "I've been saying for years," he explains, "you guys running the big aerospace companies, you can't build a new airplane alone. The cost is prohibitive. You've got to go into it together."

Far from being stiff and restrained, Knut Hagrup punctuates his speech with a light-hearted humor and an occasional Norwegian "O, ja, ja!", amused at the size and scope of the airline industries and fascinated by the forecasts of even greater aircraft and larger business ventures. When he says "Boeing," "Douglas," "Fokker," or "Saab," he speaks with all the knowing affection of a family airline-man who has participated in the growth of aviation industries from fledgling companies to their present status as considerable politico-economic powers. American aircraft manufacturers at Boeing and Douglas know him affectionately as the man responsible for ordering over a billion dollars of American aircraft equipment as President of Scandinavian Airlines.

Normally, as he explained, a Swede doesn't understand Danish, and a Dane doesn't understand Norwegian, but Knut Hagrup speaks all three Scandinavian languages plus German, English and now, French. "So, in my old age," he chuckled, "after two doctorates, I am going to speak French." His international versatility is probably one of the reasons he was chosen as President of all the airlines in the world through the International Air Transport Association, and the Association of European Airlines. His multi-national education also contributes to his distinguished career. He earned a doctorate in Economics from the University of Dresden and a doctorate in Technology from the University of Stockholm, both after retiring as President of Scandinavian Airlines! His thesis on World Aerospace, will be published this year as a resource book for the aviation industries.

His airline ticket, which usually reads: Oslo-Stockholm-Paris-New York, will now be extended to include Los Angeles, as Dr. Hagrup has accepted a Laureate Professorship of Law at Northrop University, joined the Board of Trustees and plans to attend quarterly meetings. As a measure of his friendship, and with his usual convincing smile, Knut Hagrup gave the following interview to **Nuance** as an invitation to share in his fascination with the progress of the giants in world aerospace. (continued)

Nuance: What is your main purpose for visiting the United States this trip?

Hagrup: I come to the United States more or less ten times a year, and that is basically to keep myself briefed on the progress in the airline and aerospace fields.

I'm on the Board of Saab-Scania which is making the military fighters for Scandinavia. Since Saab-Scania is involved in making passenger aircraft with Fairchild, in the Saab-Fairchild venture, they need someone to keep them informed as to what is going on in America. So, this is one of those trips to learn and listen.

Tomorrow, I am going to McDonnell-Douglas to find out about their new business plan to work with Fokker (Amsterdam). They have a statement of understanding that they might build an airplane together. They are going the right way, as I see it, because the cost is so high. It was stated that the development costs, before they even start building, will be around 2 billion dollars. No one can afford this cost by themselves. They also stated that they are looking for more partners. Boeing already has the Japanese investing 15% of the total of their development costs, with the Italians contributing another 15% of the total costs. Boeing also has a number of manufacturers in the States helping them out; Boeing is 50% involved and is the leading party. It's Boeing that builds the plane. (chuckles)

Nuance: Will the agreement between Douglas and Fokker discourage a European market of cooperation?

Hagrup: Well, the Europeans are really already together, because the British, the French, the Germans, and Fokker, to a small part, have joined and are making the 'Airbus', which is very successful. The Airbus has sold **300 planes**, throughout the world. It is a large plane carrying 250 passengers.

So, Europeans have already started building together. But their goal is to have more business. And, of course, if aerospace companies like Saab and like Fokker start cooperating with the Americans, then it is more difficult to make a European cooperative venture. So, yes to your question. But I think the solution should be that some European companies work together and some of the manufacturers deal with the Americans. I think that is the best balance.

We have yet to see what will happen with Fokker, which is now involved with a European company building Airbus and with the American company, Boeing. That must put a terrible strain on the management with lots of travel, discussion, board meetings and all.

Nuance: What do you see in aircraft development in the next decade?

Hagrup: I think the main thing we will see in this decade is that manufacturers will work on making the aircraft lighter. They will bring in composite material which makes the whole aircraft lighter. That means they will take more payload for the same fuselage. Then they will see to it that the aircraft uses less fuel. They will have better engines using less fuel.

I think you will see that the size of the aircraft will increase. You will see much bigger aircraft carrying 800 to 1,000 passengers.

...the U.S. export value of civil and military aerospace equipment is already second only to agricultural exports of the U.S. This means that aerospace is a greater export branch for the U.S. than their automobile industry.

Nuance: Do you see Northrop's Flying wing as a practical design?

Hagrup: Technology can already forecast that when you build an aircraft with say, 1,000 seats, in order to carry the fuselage you must have huge, very long, wings. In order to make them strong enough, you must have them thick enough to walk in. When you come to that size, then why carry the fuselage? When you carry passengers in a wing, why do you need a fuselage? Jack Northrop has proved it can be done. If the passenger numbers get up to 1,000 per aircraft, you will see the Flying Wing.

Nuance: Will they be able to use some of the existing aircraft to make into newer models?

Hagrup: The 747, as it is, can be made longer by many, many yards. And then, you know they have a second floor which can be made to continue to the tail. Boeing has said the 747 can easily carry 700 passengers. They will have to use stronger engines, but the 747 is forecasted for change. It can be modified.

The only thing that will stop airlines from asking for much bigger aircraft will be the size of the airports. Big aircraft take a lot of space. But on the other hand, instead of airport's being overcrowded and planes' having to wait to take off and land, you can land with 800 passengers in one plane instead of four planes.

Nuance: What about development costs of the new aircraft?

Hagrup: No manufacturer will build aircraft for 800 passengers if he can't sell 500 aircraft; he will lose money. That's the break-even point. Write off 5 billion dollars for the development in the first 500 aircraft. If he can't make that, he will sit with the costs. Of the Boeing Jumbo jets, I think there have



Lockheed L-1011 Tri-Star in production at America, 25% is in Europe and 25% is in **Palm** the T



Palmdale, California. Today, 50% of world traffic in terms of the number of aircraft, is in the Third World.

been 450 or 500 aircraft sold so far. They are just about to break even.

Douglas has said they have not broken even on 1,000 DC-9's! They have sold the aircraft perhaps too cheaply. Or they have modified and made so many different types that the cost has been astronomical.

Nuance: What is the biggest motivation behind cooperative manufacturing of aircraft?

Hagrup: The development costs are prohibitive for only one manufacturer. You see, before you start building an aircraft, there is an outlay of money between 1 and 5 billion dollars. Douglas and Fokker are saying that the airplane they are going to build will have a development cost of 2 billion dollars. And that is for making all the designs, testing, discussions with the authorities, the making of a prototype, and the breaking down of one model aircraft.

Then, after five years of work, they will start selling the first aircraft. And five billion dollars is gone. You see, Boeing is not worth five billion dollars. Maybe not even two billion. They go into debt more than the company is worth. So if they went broke, they couldn't pay the shareholders. Now companies are saying, "We can't go into this alone."

Nuance: How is the air traffic growth world-wide?

Hagrup: Air traffic is increasing in Europe at a faster rate than in America. But if you look at the world, you have to look at more than just one bad year. At the moment, the increase in air traffic isn't too good any where in the world, expecially not in the States. So I wouldn't talk about this year, anywhere. (chuckle)

If you look back three or four years, or look ahead seven or eight years, all traffic forecasters see an increase in air traffic. Next year in the States they predict a 6% increase, in Europe an 8% increase and a traffic increase in underdeveloped countries of, say 15%. In certain third world countries, an increase of 12%.

So many people in America fly now, that the rate of increase in passengers is slower. And that's the reason the aerospace industry will have a healthier expansion in the number of passengers and the number of aircraft built in Europe and the Far East than in America. As of today, I would say 50% of world traffic, in terms of the number of aircraft is in America; 25% is in Europe, and 25% is in the Third World.

In eight years, I think you will see that the air traffic of the world will be only one-third in America, one-third in Europe, and one-third in the Third World. This is not counting the Soviet air space, because it is really too difficult to know much about their aerospace industry.

Nuance: What is the financial size of the Western world's civil aerospace?

Hagrup: The financial impact of the Western world's civil aerospace business is, as a matter of fact, enormous. The total value, including aircraft of all sorts, their need for maintenance, fuel, airport handling, etc., is estimated to be about 470 billion dollars in the time period of 1979 to 1988.

As an example of the comparable size of the aerospace industry, the U.S. export value of civil and military aerospace equipment is already second only to agricultural exports of the U.S. This means that aerospace is a greater export branch for the U.S. than their automobile industry.

Nuance: Do you see the shortage of fuel as causing a depression in the aerospace industries?

Hagrup: There are several factors which make aerospace fairly immune to the general economic climate or even to a world shortage of fuel. First, the unrest in Afganistan, Iran, and the Middle East makes it imperative for the U.S. and Europe to remain strong militarily.

Second, a number of developing countries outside the U.S. are now interested in starting their own aerospace industries and asking for assistance from the U.S. and Western Europe aerospace industries.

Third, the executive jet or business aircraft is becoming an important productivity tool in performing management operations. Sales of these new aircraft are increasing.

Fourth, the low fares introduced by airlines in 1978 have given a tremendous boost to the world air transport industry. The airlines are ordering new aircraft as never before.

Nuance: In terms of employment figures, how large is the aerospace industry in Europe and America?

Hagrup: There are about 500,000 people in the aerospace industry in Europe. Of this amount, 200,000 are in Great Britain. One of the reasons they are so big is that Rolls Royce alone employs 70,000 people. The biggest in output of aircraft and sales is France with about 130,000 people working in the aerospace industry. Then comes Britain, Germany, and Italy.

But in the States, I would say you have 1.4 million people in the aerospace industry. And with that you are maintaining 85% of all the commercial airlines in the world.

Nuance: How do you see Europe competing for aerospace business in the future?

Hagrup: I can see the change already. Boeing is farming out work to Japan and Italy. Douglas is farming out to Sweden. You see, manufacturers have to give work to each other. Not because they can't handle it, but because they don't dare. If they did, they would have to put out too much capital, more than their company is worth By working with European manufacturers, American companies can reduce the capital expenditure on development and in turn hope to increase their market. Europeans may be more apt to buy a plane which is also made in Europe.

I can see the shift coming, because Americans can't take the financial responsibility to build all the commercial aircraft in the world. And for competitive reasons, I think Europe realized the high technology which is available through aircraft research and development and wants to participate in it. Europeans do not want one continent to run that high technology alone. Just like the Japanese didn't want America to lead in the manufacturing of all the cars in the world.

I forecast that in about eight years America will have only about 50% of the world's production of commercial airliners, while Europe and Japan will take the rest. So it will be a 50-50 venture. It is only natural.

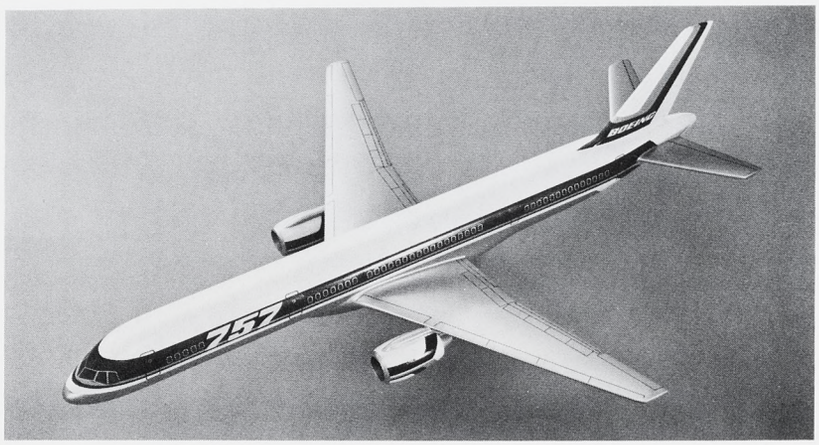
I'm not sure how much Americans are aware that the E.E.C., the European Economic Community, wants a share of the aircraft business. You make billions in aerospace and Europe wants a share. nu

World Aerospace Market

Climbing Out of the Decline By 1983 Boeing Leads the Way

The commercial jet transport market is expected to pick up and gain momentum by 1983, according to Standard and Poor's Industry Survey May 28, 1981. Meantime, because of the emphasis on new generation, fuel-efficient jets, unit shipments of current models will decline this year and next to recover with the aid of Boeing's new 757 and 767 in 1983.

Boeing seems to be the leader in commercial jet transport. They are likely to increase their 63% share of the aerospace industry this decade.



The Western European consortium, Airbus Industrie, will probably increase its 19% market share over the next several years to become Boeing's competitor in the large commercial jet transport market. In second place position, Airbus stands a good chance of obtaining more U.S. airline orders. Currently, most of their orders, aside from an all-important one from Eastern Air Lines, have been from non-U.S. airlines.

Delta Air Lines made the largest airline commitment in aviation history with the announced purchase of 60 Boeing 757's. American Air Lines followed suit by ordering 15 of the 178-passenger 757's. Boeing expects to sell 1,000 each of its 757's and 767's.

U.S. Military avionics development is expected to boost the avionics market in a growth of 15% each year for the next four years. The $4 billion dollar electonic warfare market is especially active in developing electronic counter-measures (ECM) and jamming devices.

According to Frost and Sullivan's International Business Research Reports, North America will continue as the world's predominant general aviation market, representing 90% of all registered general aviation aircraft.

Northrop University

the Heritage



In 1942, James McKinley and John Northrop, two talented friends, instituted a unique educational system designed to be immediately responsive to the growth of a highly specialized and diversified industrial nation. Education for professional advancement was the key philosophy established in a small aeronautical training school at Northrop Field, California, by the aircraft entrepreneur and designer John Northrop, and the outstanding technical educator, James McKinley. Together, they built a successful working partnership between education and industry, out of which has evolved the Northrop University of today.

Their initial vision and design of a school capable of continually updating its programs in response to new and projected needs for technical, scientific, and professional manpower has remained the viable working basis of all University planning.

The fundamental purpose of Northrop University, as reiterated by the Board of Trustees on October 25, 1980, is to continue building the working relationship between industry and education:

Purposes and Objectives

Northrop University is a small, private, non-sectarian assembly of colleges, with deep roots in the southern California aviation/aerospace industries. These colleges provide the academic setting for career preparation, involving citizens of many countries of the world. Northrop serves traditional and non-traditional students in small intensive classes and laboratories where practical applications supplement theoretical considerations.

Northrop University seeks to be a model of international cooperation among business, education, and industry. Undergraduate programs stress the cultivation of skills which translate into careers. The graduate and professional programs build upon basic skills, developing leadership and international perspective for their participants.

Throughout its programs, Northrop stresses the American ideals of the free enterprise and competitve market system, so as to strengthen the value of its education.

Northrop University
the Challenge to Grow

Over the years students have been attracted to the University's programs because they were immediately immersed in the real problems of science and industry and given the counsel and direction necessary to become readily employable and effective in their chosen fields of study.

With a basic education foundation at Northrop University, graduates have contributed greatly to international technological and professional advancements. Graduates of the University have included:

an Engineering Technology graduate who continued his education in law and is now the first American Indian with J.D., LL.M. degrees working for the U.S. Senate Committee on Indian Affairs;

an Airframe and Powerplant graduate who became the first black pilot hired by Western Airlines;

Engineering students who designed, built, and raced the world's fastest unassisted man-powered vehicle, the White Lightning, an aerodynamically designed bicycle. The White Lightning was the first man-powered vehicle to exceed 50 m.p.h;

a graduate of the Law School's Taxation Program who became the first corporate executive with Coldwell Banker to move up from secretary;

an Engineering Technology graduate who piloted the Solar Challenger across the English Channel in the first successful solar-powered vehicle;

a Management Technology graduate from the Graduate School of Business who was supervisor, Space Orbiter Shuttle, for Rockwell International.

...and hundreds of other engineering and technology graduates who have worked on every phase of space exploration from Gemini to the Columbia.

Throughout its years the University has graduated over 27,000 young people and provided them with the opportunity for upward mobility into highly responsible technical and professional careers.



"Most every project for new aircraft, missiles, satellites, and space vehicles has Northrop University graduates on its engineering team."

James McKinley

The Northrop University campus in Inglewood continues to grow with the addition and renovation of historic buildings on Arbor Vitae. More than just any Air Force buildings, the 5800 and 5760 buildings were the early site of the United States Ballistic Missile development program. Today, mathematics, law, and physics are taught in the same rooms where General Schriever, von Neumann and staff worked on the Thor, Atlas, and Titan missiles which effectively opened the era of space exploration.

Northrop University has worked to completely modernize these historic Air Force buildings. Today there are 9 classrooms a 75-person lecture hall, 3 large seminar rooms, a student lounge, Law Review Office, and 8 faculty offices in the 5800 building. In addition, a generous donation of courtroom furniture has given the Law School an outstanding moot court. Today, there are over 300 law students using the spacious law library and classrooms in the 5800 building.

On the other side of the circular driveway on Arbor Vitae, the remodeled 5760 building houses the main administrative offices of the President, Academic Deans, Accounting, Data Processing, Physics, and the Language Institute.



The Students

During the past few years there has been a concerted effort to provide greater ability for interfacing with the students on the campus. The student activity fee has helped the students enrich their programs and provide many needed social activities. Such things as movies, camping trips, lectures and rock concerts have become a part of campus life. The students also fund and publish their own student newspaper, THE LOG.

The facilities of the first engineering building have been restructured and designed to meet the students' needs. Within the Student Union you can find a Fitness Room designed for a complete workout, equipped with Universal Gym equipment, dressing rooms, showers and lockers. By the end of the summer, the Union will have a music system throughout, as well as new furniture and carpeting.

The McKinley Residence Hall and Dining Commons have a new look this year. Extensive painting and refurbishment exphasize the look of apartment living in each of the private suites. The Dining Commons' woven curtains and three-color decor create the atmosphere of a private University Club.

Northrop University

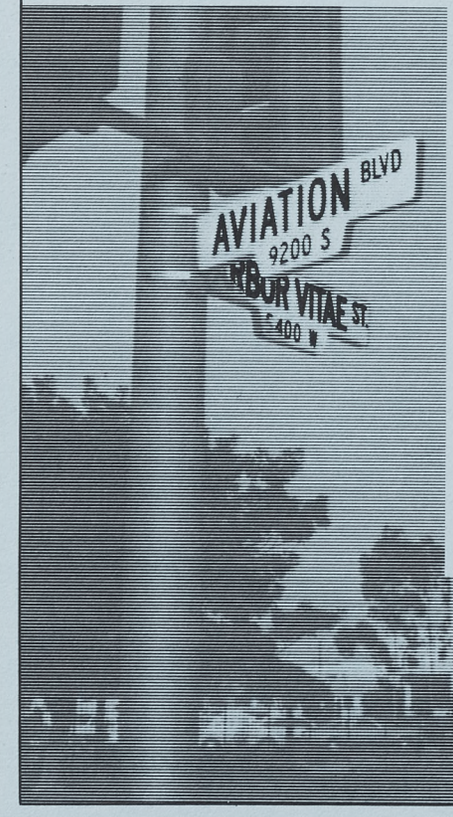
the Expanding Partnership

In 1982, Northrop University will celebrate its fortieth year in post secondary education. Growth of the initial aeronautical training school into a degree-granting university with four separate colleges indicates that the vision of the co-founders has been successfully developed. The close working partnership between industry and education has been the key to Northrop University's growth.

A continuing demand for graduates of Northrop University throughout the years and the reputation of the alumni within their professional fields has created a constant market for present and future students.

As a private, non-profit, independent institution, Northrop University looks to those supportive people who share its sense of mission to continue their active financial contributions in the years ahead. The University greatly welcomes the opportunity to interface with interested industries and international organizations in an effort to respond to the need for educated manpower.

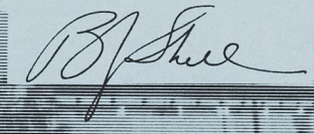
We have been privileged to create many special educational programs for nations around the world and have attracted students from more than 50 countries to our campus.



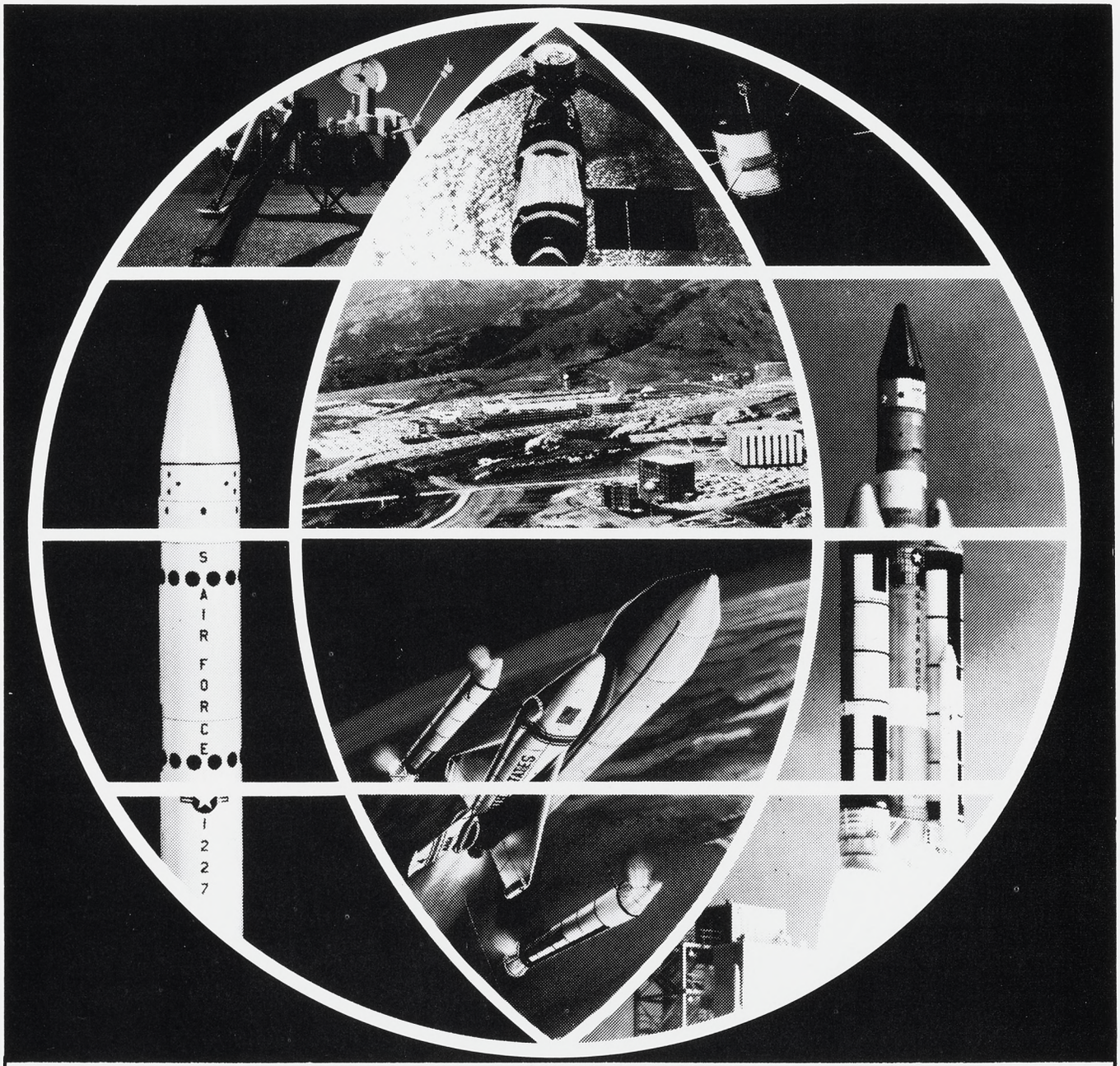
Alumni, corporations, businesses and individuals have made possible a great deal of university growth in scholarships, equipment, stocks, art-work, and capital. The Law Library, Moot Court, and $1.5 million worth of equipment for the Institute of Technology are recent direct results of generous gifts to the University. This is the strong enthusiastic support and encouragement the University needs to grow.

The faculty and staff of Northrop University are committed to preparing students to respond to the future needs of science and industry. To be successful in this venture, the University needs strong, committed financial partners. We invite you to take a personal interest in the University. We are small enough to be responsive and direct, yet large enough to be known throughout industry as a continuing source of graduate engineers, lawyers, technicians, and management executives.

We invite you to join with Northrop University in its commitment to strengthening the partnership between education and industry for a secure, productive future.



For further information about how you can participate, contact the Office of the President, Dr. B.J. Shell, Northrop University, Inglewood, California 90306 (213) 776-3410.



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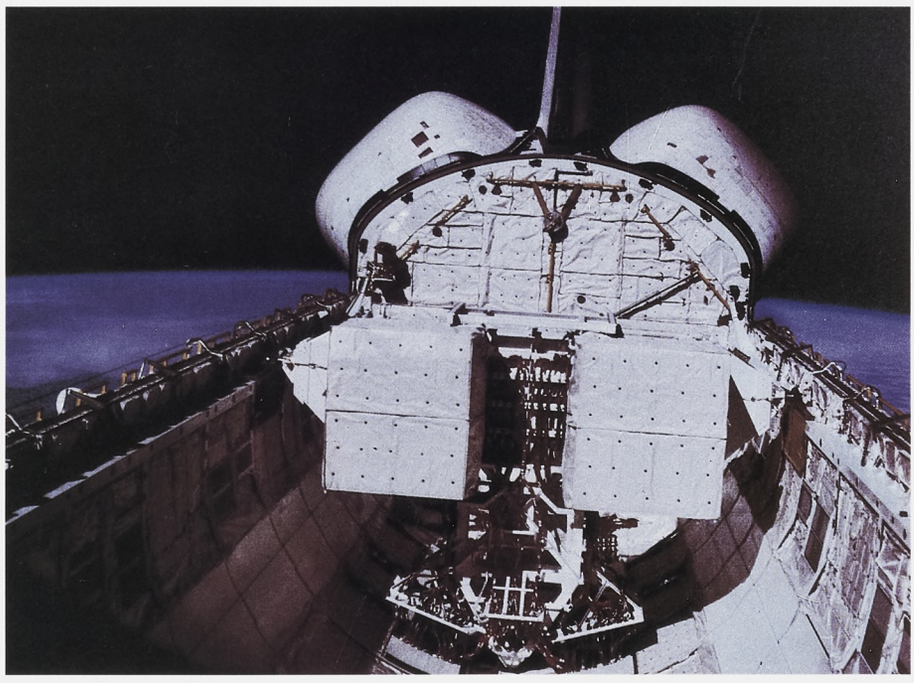


FUTURE FLIGHT

BEYOND THE SHUTTLE

In just twenty years, space has become a multi-billion dollar business. Satellites, originally the size of grapefruit, now rival the size and weight of large tractor-trailer trucks used in interstate commerce. The future could see suspended cities, space colonies, agricultural outposts, and solar power stations.

In the commercial world, it has taken just one decade for the global communications satellite to establish itself as the dominant carrier of international communications. Now, one billion people routinely depend on the "live" broadcasts of



BY STANLEY ALBRECHT

international events via communication satellites.

The Western Bancorp Data Processing Company uses secure satellites to connect its regional data processing centers. The Bank of America has recently quadrupled its dependence on high-speed space communications. It is safe to say that the recent dramatic growth of our banking industry would come to a quick halt without space.

Use of the commercially available landsat images of Earth allows us to measure snow pack in the Himalayas, the Sierras, and the Rocky Mountains. Landsat makes it possible to estimate water runoff for crops, the amount of deforestation in the Amazon, the extent of drought in sub-Sahara Africa, and the eventual forecasts of U.S. and world crop yields.

Militarily, being able to know the exact position of enemy forces permits us to intelligently plan prevention measures. Command of the high ground in space is valued as the best deterrent to attack. This in itself is worth the billions of dollars spent on space programs.

Now at the successful completion of the first Space Shuttle flight we may well ask ourselves, "What steps will follow the Shuttle?" On the cutting edge of deep space, what future technologies should be developed?

Research for these types of questions must consider what kind of payloads we need to carry into space, and where in space they will be taken. To understand the direction we will take in space, our key national needs must be identified. The GLOBAL 2000 Report, completed for President Carter in 1979, and the Cambridge Reports, a quarterly public opinion poll, identified four areas of major national concern: energy resources, defense in an unstable world, economic stagnation, and a social revitalization.

Providing goals in each of these problem areas leads to a plan for the future. An effective space program would be responsive to these goals.

The 1980's can be considered a time of space capability buildup. Our Space Transportation Systems (STS) today are capable of putting military satellites as well as commercial satellites and probes for communications, observation and planetary exploration into space. The 1990's will see early space utilization with manned space platforms, manned transfer vehicles traveling from one orbiting satellite to the next, and military space command posts with more advanced weaponry and surveillance equipment. The decade beginning 2000 could provide a commercialization of space. We would be able to support space manufacturing and solar power stations in orbit. Militarily, we could have a U.S. security system with high energy weapons, and integrated surveillance from a space command post.

Within the next hundred years, man will be an extraterrestrial traveler and colonist. Renewable sources of energy will be harnessed. A more global information system will exist and military command in space will allow U.S. security. In just one century, transportation within the solar system will be available much as intercontinental travel today.

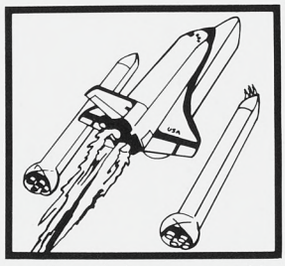
An Earth Support Base will be the key to the space effort during the next two decades. Space technicians at the Support Base will build and maintain space platforms. A Low Earth Orbit military space command post and space factories will be an outgrowth of the base. It is expected that the base will also provide support for construction of a pilot solar power plant.

In the second decade of space outreach, military posts, material processing, and energy generation will all move to space orbits. A geostationary space base will be constructed to support the increasing activity at geostationary orbit 22,000 miles above the Earth. This orbit path already contains more than 90 satellites, and is undoubtedly of primary economic and strategic importance. A space base at geostationary orbit will improve a U.S. security system late in the third decade.

During the remainder of the next 100 years, it is anticipated that man will continue expanding his activities in near-earth space and will begin to expand and explore the solar system through manned spacecraft and manned space platforms.

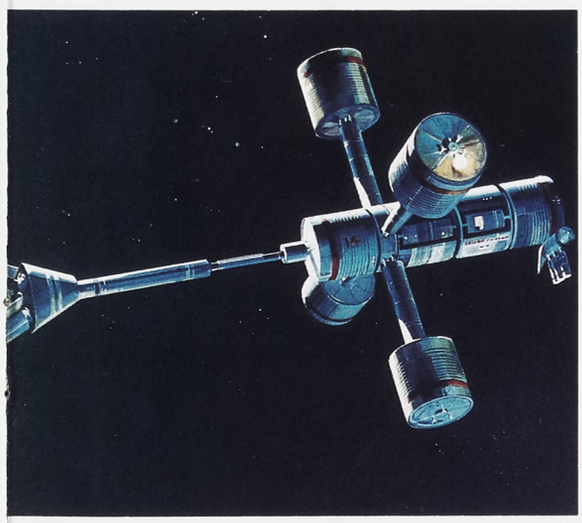
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The Space Transporation Systems (STS) needed to support an expansion into extraterrestrial territory are classified as three different types: the Heavy Lift Launch Vehicles; the On-Demand Launch Vehicles, and the Orbital Transfer Vehicles. The Columbia Shuttle flights will help determine the requirements for these futuristic vehicles.



The Heavy Lift Launch Vehicles, used primarily with civilian payloads, are designed to improve the performance of the Space Shuttle and to boost payloads larger and heavier than the 65,000 pound limit of the Shuttle. A heavy-lift concept using liquid-propellant boosters would provide a payload capability of up to 100,000 pounds while reducing the cost per flight. Immediate development could

B.



C.

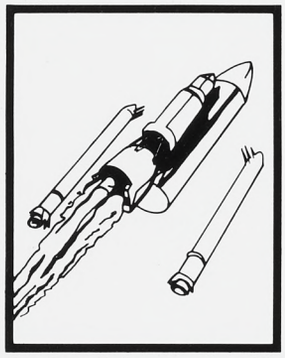
The Shuttle is carried to altitude launch by supersonic transport.(A) From there, the Shuttle propels to orbit where it docks at space station.(B) Work crews within station construct future space factories (C).



A.

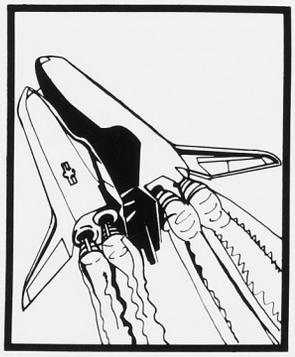
bring this system into operation as early as 1990.

Another space transport option, which could boost payloads of up to 150,000 pounds to low-earth orbit is the Aft Propulsion Module. This unmanned concept utilizes the current external tank and solid rocket boosters together with a reusable propulsion module. The payload is mounted forward of the propulsion module; thus, the two elements replace the orbiter in the basic Shuttle vehicle configuration.



The launch ascent path for this Heavy-Lift-Launch Vehicle is similar to that followed by the orbiter. The propulsion module, after separating from the payload, is targeted for return and recovered for reuse. It is configured as a controllable ballistic entry body. During landing, a main parachute system slows the vehicle for the final few thousand feet of flight. Just prior to reaching the ground, retro-rockets fire to reduce the vertical descent rate, and the module touches down on deployable landing gear skids. The propulsion module is derived by modifying the aft fuselage of the orbiter and its subsystems. In this design, many of the baseline orbiter elements are used as is, or with minor modifications, providing a significant increase in capability at very modest development cost. Beginning design under a moderate level of funding could permit flight of this configuration as early as 1987.

The construction of commercial solar power satellites early in the 21st century will require a launch vehicle with payloads in excess of the two previous Shuttle derivatives. A two-stage verticle take-off vehicle can boost payloads of a quarter million pounds or more. This two-stage vertical take-off configuration uses a winged booster which takes the larger orbiter part way to altitude, then glides back to an unpowered landing near the original launch site. The orbiter, which is more than 2 times the size of the existing Shuttle, continues on to deliver materials to the solar power station. While on orbit, the orbiter transfers fresh work crews to the station and then returns to a Shuttle-like landing for refurbishment and preparations for the next launch. A solar power satellite designed to provide continuous power to a city the size of New York would require 440 flights of this vehicle beginning shortly after the year 2000.



In contrast to the commercial needs of large, heavy payloads to support on-orbit construction, is the need for an advanced military spaceflight capability. Vehicles of this type could take one of several proposed configuration shapes. It would posess higher survivability from enemy attack, quicker response for launch in the event of an attack or need for immediate reconaissance or rescues, and in general would support a much wider range of missions. Because of the short turn-around requirements of the Air Force, most if not all of the vehicle elements should be readily reusable. While this imposes a higher development cost for the system, it does lower substantially the day-to-day operational costs.

A manned space utility vehicle launched from a C-5A transport has been proposed. Because of the size and weight limitations of the transport, the spacecraft payload is limited to about 4000 pounds. figure A. shows the principal events of a typical launch sequence. A drogue parachute extracts the space system from the carrier aircraft over the launch zone. After being stabilized in a near-vertical attitude by the main parachutes, the booster engine is ignited and the space system flies past the collapsing chutes. After its orbital operations, the small orbiter would return to a normal landing at any of several military airfields.

Command of the high ground in space is seen as the best deterrent to attack. Advanced military spaceflight will be able to respond to immediate rescue and reconaissance needs in space.

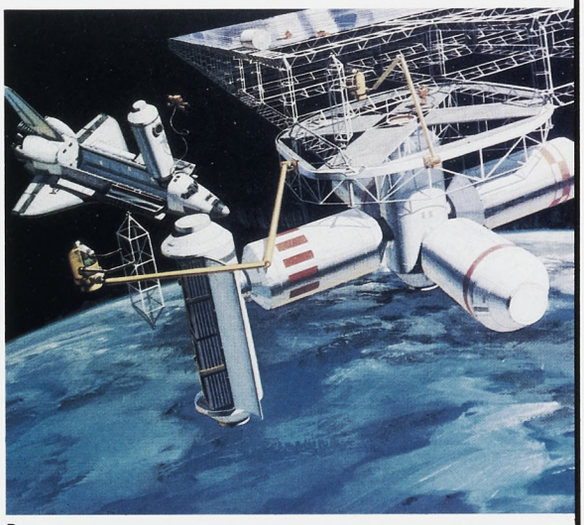
Somewhat larger payloads associated with space station construction, for example, could be carried by a horizontally launched system such as the Sub-Sonic Launch System. The orbiter is first towed under and mated with the larger booster in preparation for a quick-response launch. The jet-powered booster then lifts the system to altitude where the orbiter is dropped. The orbiter engines then fire, and it is propelled to orbit on its own power. As in the case of the small utility vehicle, the orbiter may be transported to anywhere in the world for deployment, and may land on any conventional military runway. With the installation of a payload module, the booster can also be used as a transport vehicle for cargo or personnel.

As in the case of both the commercial and military systems, a number of configuration concepts have been suggested for Orbital Transfer Vehicles. These vehicles take their payload and/or

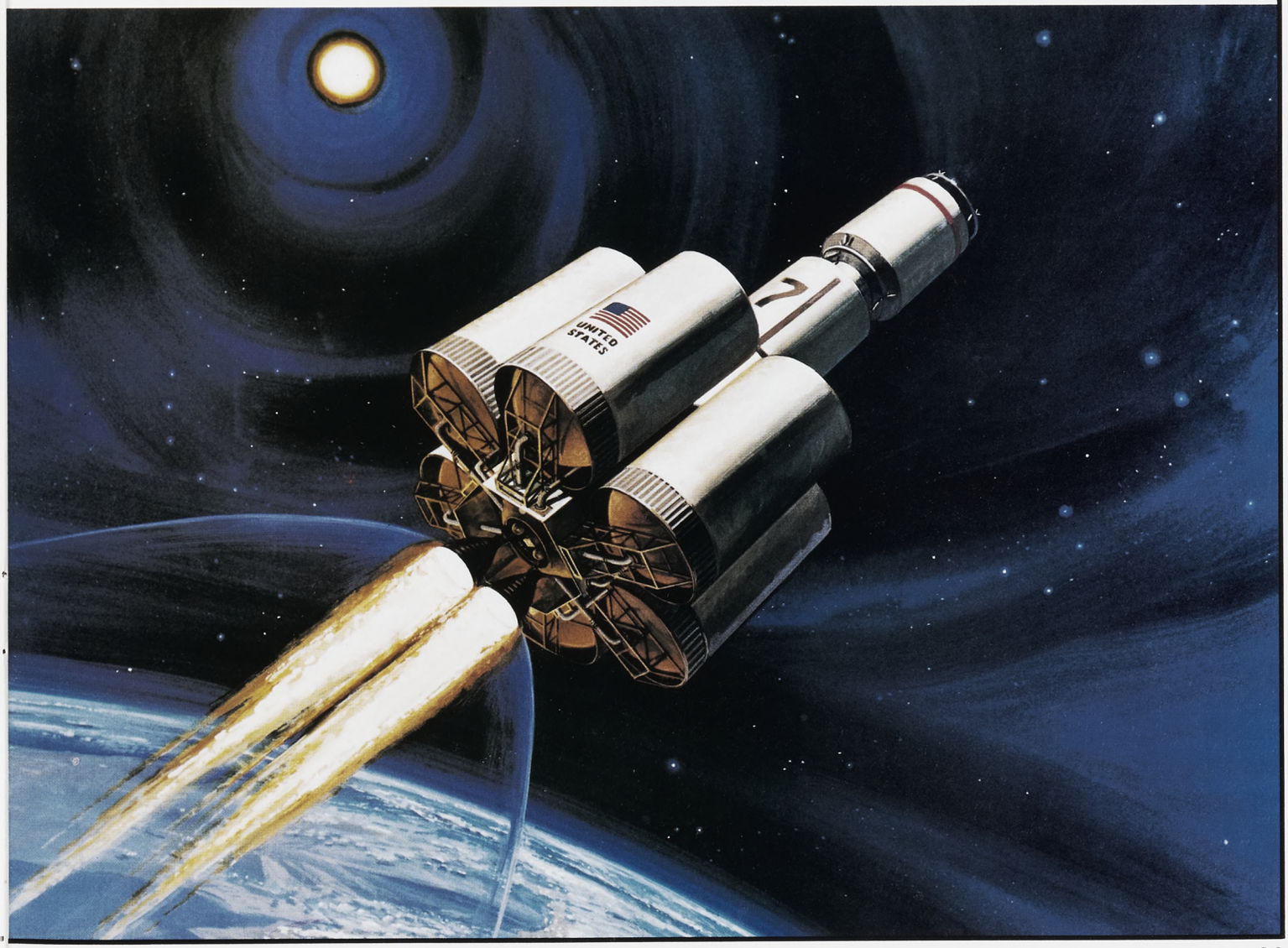


A.

Manned High Energy Systems (C) will take men to geostationary orbit where a military communications satellite (B) awaits smaller space utility vehicles launched by C5A transports (A).



B.



C.

WORKING IN OUTER SPACE

As man begins to colonize space, technicians will be needed to build the structures which will eventually become space cities. Part of their essential equipment will be a Manned Manuevering Unit (MMU) which will allow astronauts to fly around in space independent of their space craft.

Crewmembers will be able to exit the space vehicle as a separate mobile unit capable of constructing the antennas, space platforms, laser reflectors and laboratories while suspended freely in space.

The MMU, developed by Martin Marietta, is designed to be carried in the payload cargo section of the next Space Shuttle flight. Crewmembers will be able to exit the space vehicle to make repairs on the heat shield tiles, or fly out to repair a satellite and retrieve it, if necessary.

The propulsion backpack allows the astronaut to thrust himself in any direction, while the sticky pods on the Work Unit permit him to stick to the side of the Shuttle to repair it. A Return Tether Line System, much like a fishing reel and line, attaches the astronaut to his vessel until the backpack can be proven reliable in outer space. If something should go wrong, the crew member could reel himself back into the Shuttle.

Alumnus Tim Boersma, a graduate of Northrop University's Aeronautical Engineering program, was responsible for testing all the subsystems and components of the MMU to make sure it would work as designed for outer space.



crew from one orbit to another. One mission is to take both men and equipment from the Low Earth Orbiting Space Base to the Geostationary Space Base forecast for construction in the late 1990's. However, many missions, and consequently designs, may be postulated for orbiter transfer vehicles. One concept for transfer of both men and equipment to geostationary space base is the Manned High-Energy Mission System. Multiple sets of tanks clustered about a center core are burned in succession and then staged, leaving only the core, engine, and payload at the completion of the round trip mission.

Space command, cultivation, and colonization depend on our space transportation systems. After the shuttle come continuously manned operations in space...the extraterrestrial step. nu



Stanley Albrecht, B.S.A.E. and B.S.E.T. is a preliminary design engineer with the Advance Systems Department of Rockwell International's Shuttle Orbiter and Integration Division in Downey, California. Currently, he serves as secretary of the Alumni Board of Directors of the University.

Reader Survey Response

Dear Nuance Reader,

You have responded from around the world to let us know what you like best about **Nuance** and what you would like to see in the future. Some interesting information surfaced.

Out of a total response of 180, 83% were Alumni. Most of the Alumni responses indicated they liked to read about other Alumni of accomplishment. In fact, readers liked the Alumni Profile department so much, they wanted to see it increased.

Alumni Profiles, High Technology feature stories, and Development Plans of the University were the three top requests from those readers who responded.

A tabulation of the responses indicates most of our readers graduated in the 1960's (41% of them). Coincidently, **Nuance** featured the 1960's at Northrop University in the Winter 1981 issue.

Most responses came from California; however, readers responded from Texas, Washington, Nevada, Germany and even Rio de Janiero. Readers should be congratulated on the ingenious ways they discovered to fold and mail the questionaires. It was a challenge to open them and a combination of surprise and wonder to read them.

Many varieties of occupations were found among **Nuance** readers. Among the many professionals were logistics specialists, electronic circuit designers, airline pilots, public defenders, and missionary pilots.

Twenty-seven readers had never been in contact with Northrop University before they responded to **Nuance**. Eighty-seven readers had only an infrequent contact. **Nuance** has opened a channel of communication with alumni and friends which will be encouraged to continue every way possible.

Each issue will respond to the areas of emphasis requested by readers. In order of preference, the areas are:

#1 Alumni Profiles
#2 High Technology Articles
#3 Campus News
#4 Class Notes
#5 Trustee Features

The favorite characteristics of **Nuance**, as indicated by readers, are: the variety of articles; the new image of the cover and the use of color; and the arrangement of the magazine in a feature article format, rather than a newsletter.

Seventy-eight readers felt they would like to participate in **Nuance** by submitting articles for publication. Seventy readers indicated they would pay for a subscription to **Nuance**. Eighty readers felt they wouldn't subscribe and six readers wanted to think about it.

We hope you think about writing to us and letting us know what you would like to see in **Nuance**. We want to meet you and hear your comments. Here are a few comments from fellow readers:

"...concise articles..."
"...a good balance of subject matter."
"...very fine professional publication..."
"I like to share it with my co-workers."
"Its format reads fast and easy. It's perfect for a busy person."
"I am a past president of CAEA and speak to many high school students on career alternatives. I appreciate being on your mailing list."

Thank you,
The Nuance Staff

STREET LAW PROGRAM

The National Street Law Institute is the program from which Northrop University designed its own Street Law Program. The National Street Law Institute was founded approximately nine years ago at Georgetown University School of Law, and there are approximately thirty-five law schools across America which are currently involved in administering similar programs.

Northrop University's Street Law Program puts upper-division law students into the high school classrooms teaching survival topics in the law to junior and senior high school students. Topics which are of great importance to everyday living include Housing Law, Criminal Law, Contracts, Torts, Family Law, Constitutional Law, and Consumer Law. The program teaches not only through lecture, but classroom involvement, role-playing, mock court trials, and mock arbitration meetings. Field trips to court houses and use of classroom speakers who are expert in specific areas of the law are encouraged.

Currently, Northrop University's Street Law Program involves five school districts including Palos Verdes, Compton, Inglewood, Torrance, and Centinella Valley. To date, approximately 1,000 high school students have been reached.



Members of the Street Law Program (left to right) Robert Spellacy, Crystal Ingram, Michael Madigan, Lorna Furhman, Dan Nelson, Paul Pompian, Don Buchtel, (seated) Maureen Duffy-Lewis, Esq., Instructor.

FLYING WING PAINTING

Requests for copies of the Flying Wing oil painting by Douglas Ettridge (**Nuance** Winter 1981 issue-page 10) have initiated a production process to make copies available by the Fall. Douglas Ettridge has kindly waived any copyright fee or interest in the painting so that it can be reproduced and distributed through Northrop University.

Information and requests regarding the painting should be made to:

Publications Office
Northrop University
Inglewood, CA 90306



Among special guests at the March Commencement were Ernest Hahn, (right) who received an honorary Doctor of Science, accompanied by his daughter, Chris Doss, and President Shell.

UNIVERSITY MOURNS LOSS OF DR. C.T. REID

The first Career Placement Officer at Northrop University passed away April 20, 1981. Dr. Reid came from a long career in aviation, having worked on the flight of the first plane ever built by Douglas Aircraft Co., and even taking part in the historic flight as a passenger.

Northrop University President James McKinley hired Dr. Reid in 1951 as a Special Assistant to the President. He served the campus community, graduate and undergraduate students, through his retirement date in 1966. Mr. McKinley characterized Dr. Reid as a "dedicated, public spirited individual of high character and deep religious convictions...having a high regard for young people."

Dr. Reid was also instrumental in obtaining important curricula development in the beginning of Northrop University academic life. He was awarded an Honorary Doctorate of Science in 1976.

Dr. Tom Reid will be deeply missed by all whose lives he touched.

SPECIAL LIMITED OFFER ON HATFIELD BOOKS

For a limited time, readers of **Nuance** will be able to purchase David Hatfield's Aeronautical History Scrapbooks at special discount prices. These prices will be in effect until October 31, 1981.

For a price list and book descriptions send requests to:
Publication Office
Northrop University
Inglewood, CA 90306

DAVID HATFIELD AVIATION SCHOLARSHIP FUND

Northrop University in conjunction with the Friends of David Hatfield, Aviation Historian, have established a David Hatfield Aviation Scholarship Fund. Scholarships will be awarded to undergraduates with a superior performance record in aviation related fields.

DEVELOPMENTS AND DONATIONS

THE INSTITUTE OF TECHNOLOGY

Director Joe Miles reported that in 1980-81, equipment worth over 1.5 million dollars has been donated to the Institute of Technology. This equipment ranged from a DH-125 Hawker Sibbley Business Jet to avionics equipment and hard-to-get maintenance manuals. Most of the donated equipment and materials are used for instruction and student projects.

THE SCHOOL OF LAW

The School of Law received grants from the National Street Law Foundation, the Western Harness Charity Foundation, and from Northrop Corporation. Donations of law books have come from faculty, major law firms, and individuals. As a consequence, the Law Library has grown to 50,000 volumes. The entire law collection is now housed in a special Law Library with over 6,000 feet of shelving in the 5800 building.

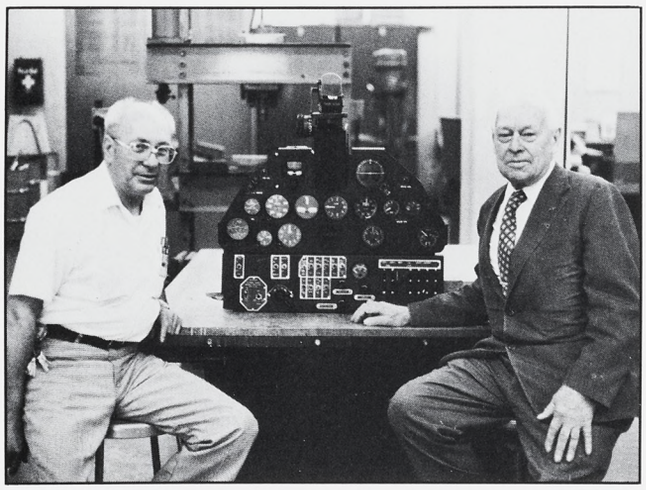
The Spring Quarter registered over 300 students in the Law School.

THE COLLEGE OF ENGINEERING

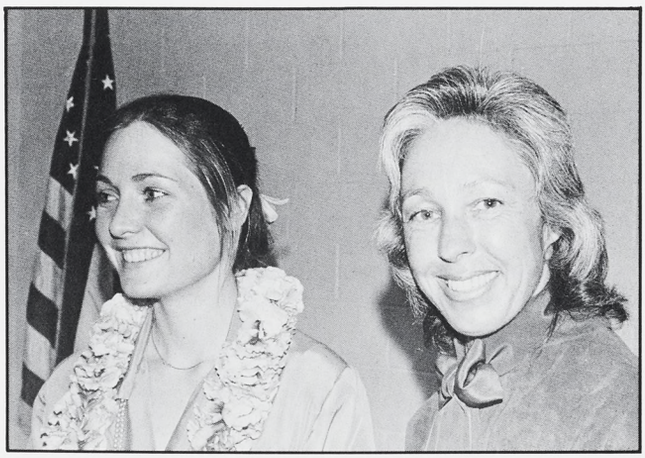
The Institute for the Advancement of Engineering again contributed funds to the College of Engineering for developing engineering projects.

CAMPUS COMPUTER CENTER

Several valuable micro and mini computers have been donated by industry to the West Campus Computer Center to provide hands-on computer training for engineering and business students.



Mo Miles (left), instructor at the Institute of Technology, and David Hatfield, aviation historian, collaborated on the recreation of a cockpit for Columbia Pictures production of 1941. After twenty-five years as an instructor and an integral part of Northrop University's development, Mo Miles passed away this February, 1981. His friend, the aviation historian, David Hatfield, passed away this June, 1981.



For the first time in the history of the Institute of Technology, a woman received top scholastic honors! Diana Bell, left, received top honors for her achievements in the Airframe and Powerplant 58 week program this Spring. On-hand to congratulate and encourage her was famed aviatrix, Wally Funk, right, the first woman to complete the accident investigation training program at the FAA Academy in Oklahoma City.

CAMPUS DEVELOPMENT

West Campus has seen extensive remodeling in the last six months. The 20,000 square feet of what used to be cubicle type offices have been transformed into nine large classrooms, a 75-person lecture hall, 3 large seminar rooms, a student lounge, a Law Review Office and 8 faculty offices.

In addition, thanks to the donation of genuine court room furniture, the Law School now possesses a Moot Court of the finest quality.

SPORTS EQUIPMENT AND FACILITIES

The campus has been remodeled to include within the Residence Hall area, an atheletic field, a tennis court, and finally a basketball court paved, painted and fenced.

The Student Union now has the facilities for weight-training, karate training, and a shower room.

NEW TRUSTEES

Northrop University 's Board of Trustees recently welcomed several new members:

Mrs. Evelyn Bray,widow of the former Chairman of the Board, Dr. Ulrich B. Bray, Pasadena;

Mr. Louis M. Brown, Attorney with the Law Offices of Sanders, Barnet, and Goldsmith, Los Angeles;

Mr. C. Ron Collins, Attorney with the Law Offices of Hughes, Hubbard, and Reed, Los Angeles;

Mrs. Virgnia Carson, former President of Pro-America, President of Americans for Free China, Los Angeles;

Mr. Francis Dedona, President of Arrowsmith Industries, Los Angeles;

Dr. Knut Hagrup, former President Scandinavian Airlines and present Chairman of the Saab-Fairchild Venture, Norway;

Dr. George Hart, Director of the Baromedical Department, Memorial Hospital, Long Beach;

and **Mr. John Northrop**, Linear Corporation, Inglewood.

YOUR ALUMNI BOARD IN ACTION

Stanley Albrecht (BSAE '79; BSET '79), Secretary-Treasurer of the Board of Directors and Chairman of the Alumni Giving Campaign, delivered a short talk on behalf of all Alumni at the John Northrop Memorial Commencement in March.

Frank Tien (BSET/AM '77) has been asked to head up a committee to explore the possibilities of forming an active membership program within the Association. **Greg Benecke** (BSEE '79) and **Bill Denison, Sr.** (BSAME '64) are members of that committee.

Speaking of Bill Denison, Sr., did you know we have a father-son team on the Board? **Clyde Denison, Jr.** (BSET/AM '74) is the liaison between the Board of Directors, the College of Technology, and the Aviation Technician School. Other Board members who are liaisons are **Robert Furey** (JD '76), School of Law; **Ken Peugeot** (BSEE '71), College of Engineering; **Fred Pitcher** (A&P '65), School of Business; **Anthony Occhionero** (BSAME '69), Board of Trustees.

The Alumni have been given a seat on NUCAP (Northrop University Committee to Advise the President). This Committee seeks to involve all members of the campus community in campus concerns. Alumni Board President **Raul Alvarado** (BSAE '73) will represent the Alumni on NUCAP.

In an attempt to remain current in all areas and programs of Northrop University, **Ed Stephens** (BSAE '61) is chairing a series of meetings featuring guest speakers from NU. To date, we have heard President Shell and Director of the Language Institute, Diana Bahr give us insight into various activities.

The Alumni Scholarship Fund is growing, and the Committee will be meeting soon to discuss methods of distribution. **Harry Zisko** (BSET '78) is Chairman of that Committee (as well as Vice-President of the Alumni Board). Contact him if you have any suggestions to offer.

To contact any Board Member, address your letters to: Alumni Office, Northrop University, Inglewood, CA 90306.

WESTERN NAMES JANE E. LAURIE TO MANAGER

Western Airlines has promoted Jane E. Laurie to the new position of manager-route analysis.

Lauri, 38, has been Western's senior route planning analyst since 1975. In her new position, she will continue to report to Noel Schachner, Western's director-route planning.

A member of Western's headquarters staff since 1974, Laurie previously worked with the Rand Corporation in Santa Monica, California and in the finance divison at UCLA.

Laurie received her Bachelor of Science degree from UCLA in 1965 and a Masters in Business Administration from Pepperdine University in 1974. In March of 1981, she obtained a law degree from Northrop University School of Law.

COMMANDER GREEN PROMOTED

Michael P. Green was recently promoted to the rank of Commander in the Judge Advocate General's Corps, U.S. Navy.

Commander Green is presently assigned to the Military Justice Division in the Office of the Judge Advocate General where he is the Head, Legislation and JAG Manual Branch. The lawyers in CDR Green's branch review legislative proposals and initiate proposed bills of interest to the Navy Department. His branch also updates the JAG Manual, the Navy's policy and procedural directive which implements the Uniform Code of Military Justice in the Navy. His branch also provides advice to the Secretary of the Navy on complaints of wrong submitted by naval personnel against their commanding officers.

A career naval officer, CDR Green was a Naval Flight Officer before attending Law school at night at the American University in Washington, D.C. and transferring to the JAG Corps. He has had assignments as both a prosecutor and defense counsel, as well as being the Station Judge Advocate at the U.S. Naval Station, Subic Bay, Philippines.

In addition to his J.D. Degree, CDR Green received his B.S. Degree in Aircraft Maintenance Engineering from Northrop University and his M.S. Degree in Personnel Management form the Naval Postgraduate School in Monterey, California. He is a graduate of the Naval Justice School and the Armed Forces Staff College.

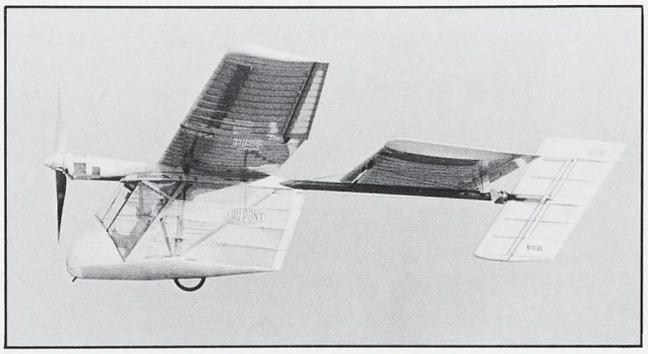
CROSSING THE ENGLISH CHANNEL BY SOLAR POWERED AIRCRAFT

Stephen Ptacek, pilot of the first solar-powered aircraft to cross the English Channel, presented a slide show of his historic flight at Northrop University this July.

Stephen, a graduate of the College of Engineering Technology in 1980, was chosen by Dr. MacCready to pilot the **Solar Challenger** because of his experience as a sail-plane glider pilot and instructor, a commercial pilot, a private pilot, and an airframe and powerplant technician.

A pilot since he was sixteen years old, Stephen plans to continue his aviation training at the United Training Facility in Colorado where he will study for his flight engineer's rating on a DC-8.

(Nuance, Summer 1981, will feature the flight of Stephen Ptacek as he crossed the English Channel by solar power.)



Stephen Ptacek, a Northrop University graduate, was the first pilot to cross the English Channel in a solar-powered aircraft. He will be featured in the next issue of **Nuance**.

N.U. STUDENTS HELP IN HOSTAGE RETURN

During the final hectic transfer of the 52 American hostages from Iran to Algeria, Northrop University Language Institute teachers watched the T.V. to see if they could recognize any of their former students. The Algerian President's Air Force crew, which corresponds to the crew of Air Force One in the United States, learned their technical English at Northrop University's Language Institute in a special 20-week training program in 1978.

Since the VIP crew of the President of Algeria had studied in the Language Institute, Director Diana Bahr thought some of the highly trained pilots participating in the hostage transfer might have been Northrop University students.

"I telexed Commandant Mahmoud Karboua of the Algerian Crew congratulating the Algerians on their participation in the freeing of the hostages and asked if any of the crew had attended Northrop University," Diana Bahr explained. The Presidency of Algeria telexed back confirming that the Commandant, himself, was a former student at the Language Institute, and the VIP Presidential crew of six pilots and technicians, all Northrop students, had assisted in the return of the American hostages.

Since technical aviation English is needed internationally for the maintenance and repair of American-made aircraft, Gulfstream sold the President of Algeria a package of English training for his aircrew with the new Gulfstream II business jet. The world-wide use of American aircraft has necessitated the development of a highly technical aviation English and Northrop University offers one of the few programs in the United States. Not only the Algerian Air Force, but foreign governments and international corporations from over forty countries have made use of a new kind of contract education at Northrop University with specially designed programs to answer the specific needs of individual groups from around the world.

SPACE DEFENSE: CLASSIFIED

A VISIT WITH CAPTAIN JAMES BOYLE

Gaining access to the United States Air Force Defense Systems is a well-guarded procedure. Security is the keyword.

The Space Defense Systems building is in an obscure corner of an inner complex of buildings in Los Angeles.

Captain James Boyle is the chief Plans Division Deputy for the Space Defense Systems of the United States Air Force. He chose to make a career with the Air Force shortly after graduation from Northrop University in Aerospace Engineering in 1971. His first project was operational. He helped launch the Minuteman III. Now, he is in charge of advanced planning for future satellite defense systems.

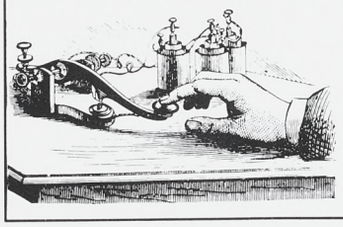
"Our system here is new," Captain Boyle explained. "We began in 1978 to plan for the protection of our satellites against attack. What we do here is find a way to render harmless or destroy enemy anti-satellites."

This new field of defense against enemy satellite attack includes the development of systems to prevent jamming, physical attack, and to insure protection of ground links. The Captain could not be specific as to the precise weaponry under development, but, he added, "We are in the era of the laser."

He has found that the great advantage to working with the Air Force Defense Systems is that the aerospace engineer has the chance to look into the future and work on the cutting edge of the new technologies. The greatest frustration is that the projects the Captain is helping to develop are so futuristic that he will probably be retired by the time they are operational.

"But," as he said, "you get to work with the latest discoveries and newest applications. That is exciting work."

KEEP IN TOUCH!



We need your change of address so we can continue sending you **Nuance**. If you are a friend of a reader, write us about what you enjoy in **Nuance** and what you would like to see. Send your request to Public Relations, Northrop University, Inglewood, California 90306 and include your name, address and occupation. We would like to meet you.

DONOR DIALOG BY ALL MEANS!

The Alumni Association works to keep all Northrop University graduates informed of what is happening on campus. It is particularly concerned with ensuring that those people who donate through the Association are kept up to the minute.

As a newsletter, **Donor Dialog** will be mailed every few months to bring the campus events to your attention as quickly as possible.

All who have contributed through the Association over the past five years were mailed a copy of **Donor Dialog** during July. If you did not receive yours, please contact: Northrop University, Alumni Office, Inglewood, California 90306.

UPDATE ON JOHN L. CHAVES

John Chaves has been appointed to serve as a member of the U.S. Senate Select Committee on Indian Affairs in Washington, D.C.

Since graduation from Northrop University with a Bachelor of Science in Engineering Technology in 1968, John earned his J.D. at Texas Southern University in 1972, and his LL.M. at the University of Washington in 1981. As of the last survey, John is the only American Indian with a graduate law degree in the United States.

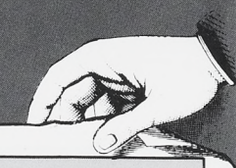


1979-80 ALUMNI GIVING CAMPAIGN

The Alumni Annual Giving Campaign for 1979-80 was extended through the end of calendar year 1980 in order to bring the campaign into a calendar year cycle. This campaign was very successful in raising funds to assist the University in its programs, including the development of an Alumni Scholarship Fund. The Alumni Association is proud to recognize all of the persons listed below as "Friends and Supporters of Northrop University" and to thank them for their generous contributions.

A very special thanks to our honored trustee, Dr. Forrest M. Bird, whose generousity has been warmly appreciated by the Alumni Association for his exemplary philanthropy.

Fred W. Aberle
Jack I. Adler
* Richard L. Albrecht
A. Raman Saeed Al-Maslamani
Harry E. Amthauer
Tom K. Arita
* Craig Arterburn
Paul Randolph Avery
Joseph Bales
* Albert C. Balkema
Roger D. Balsman
* Robert C. Baptiste
Allen G. Barclay
David J. Bean
Hanes E. Belden
Edward Bendle
* Carol Benson
Harold C. Bentley
Paul W. Bereznay
William A. Bescherer,Jr.
T * Dr. Forrest M. Bird
Roger L. Blanchard
Dr. W.H. Bortels
* Robert J. Bosnyak
Brian E. Boyer
George W. Brissey
Ralph R. Brotz
Otto Buchmeier
Melvin L. Buesseler
Clyde S. Burkhardt
Dennis A. Burnside
David M. Byington
Ernest W. Campbell
Leonard Capon
Wilbert O. Carlson
Thomas L. Carnahan
Richard E. Case
Jon A. Cashbaugh
Charles D. Cerar
Larry A. Chambers
William C. Chellew
Dean Chowning
John T. Cochran
Robert H. Consaley
Daniel E. Costello
* Thomas H. Daniels
Edward N. Danielsen
Daniel G. Deckert
Simon J. Dean
Joseph E. Demeules
A* Clyde Denison, Sr.
Stephen Dermenjian
Isidro A. Diaz-Tous
* Anthony Digiorgio
Richard T. Dimin
Anthony Dionisi
Wesley J. Dison
* Major R.B. Dodge
John P. Donnellan
Demetre Economides
Allen L. Egbert
* Susan M. Ekeren
* Larry E. Emerson
David Endo
* A.N. Escarzaga
Virgel J. Farling
* Vincent B. Fiore
* Frederick C. Fischer
Edward R. Flisher
Stephen J. Foral
Robert Fortier
Nathan Frank
David W. Frantz
Mark S. Fucci
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